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ROOSEVELT DAM AND THE SALT RIVER VALLEY

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DEFICIENT rainfall has prevented the extensive practice of agriculture in Arizona, and has condemned the state to a sparse population. Less than $\frac{1}{200}$ of its area is cultivated, and though the 5th state in size, it is 46th in population. If enough water were available, nearly half the state could be farmed; as it is, probably not more than two per cent of the land ever can be irrigated. How much can be "dry-farmed" successfully is quite uncertain. Little can be farmed by ordinary methods. The Salt River Valley about Phoenix is the leading agricultural section, its irrigated fields making nearly half (43 per cent) of the improved farm lands of the state in 1910.

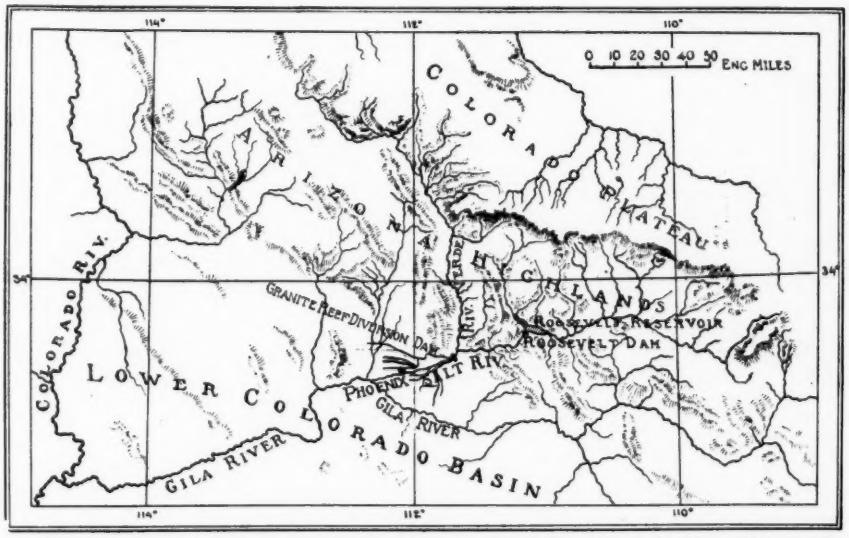

Fig. 1. Sketch map of central Arizona, suggesting the relations of the principal physiographic provinces. The map shows also the chief streams of the region, and the location of the Roosevelt Dam, the Roosevelt Reservoir, the Granite Reef Diversion Dam, and the larger distributing canals. The irrigated lands surround Phoenix.

Figure 1 shows the three great physiographic provinces of central Arizona. The Colorado Plateau has an elevation of 6,000 to 8,000 feet and is terminated on the west by an abrupt escarpment, locally 2,000 feet high, which in many places is deeply trenched by canyons. The Arizona Highlands form a belt of short, rugged mountain ranges, most of which are roughly parallel to the edge of the plateau. Some of the mountains reach

an altitude of 8,000 feet, and a few of the peaks near the headwaters of Salt River exceed 10,000 feet in elevation. Most of the rest of the area (Lower Colorado Basin; Fig. 1) is a nearly level plain, having, in the Phoenix district, an average elevation of 1,200 feet. Here alluvium, spread widely by withering streams from the uplands, buries deeply the lower parts of an ancient erosion surface. Some of the higher elevations of the old surface, half-buried in waste, rise abruptly above the aggraded plain as "buttes" and "mountains." The name "Salt River Valley" commonly is used to designate that part of the plain which borders the Salt River between the mouth of the Verde River and the junction of the Salt and Gila rivers.

Fig. 2. A scene in the desert east of Phoenix. (U. S. Geological Survey.)

Outside the irrigated tracts, the plain is a desert (Fig. 2), the rainfall at Phoenix averaging only 7 or 8 inches a year. The scattered plants of the desert represent types which have unusual ability to get water from the dry soil, or special devices to reduce the loss of water. Since little or nothing can be grown on it, most of the non-irrigable land of the desert plain is nearly worthless. To the east, the mountains and the plateau escarpment compel the passing winds to yield more rain, the amount varying almost directly with the altitude. The average yearly precipitation at Fort Apache (5,050 feet above sea-level) is about 20 inches. Many of the higher slopes are forested, and here, too, many streams rise (Fig. 1).

The Salt River and some of the other streams which flow from the relatively humid uplands have long afforded water for the irrigation of a

small part of the desert lowlands. Scattered throughout the Salt River Valley are the remains of ancient irrigation works which show that in prehistoric times more than 100,000 acres were irrigated. Modern irrigation in the valley dates from 1867, when a canal was built to divert a part of the natural flow of the river.

The volume of Salt River varies greatly (Fig. 3), and until provision was made for storing its flood waters the supply of water for irrigation frequently was inadequate. At times the volume of the river did not exceed 100 cubic feet per second, and again it was several hundred times that amount. Furthermore, variations of this magnitude have occurred within a few days. Thus on February 17, 1891, the mean discharge was 835 second-feet; the next day, 154,000 second-feet; and the next, 276,000. On the 20th, the discharge averaged 69,100 second-feet, and two days later, 14,890. A second flood quickly followed the first, and on the 24th the river was carrying 300,000 second-feet. On the 26th the average discharge was less than

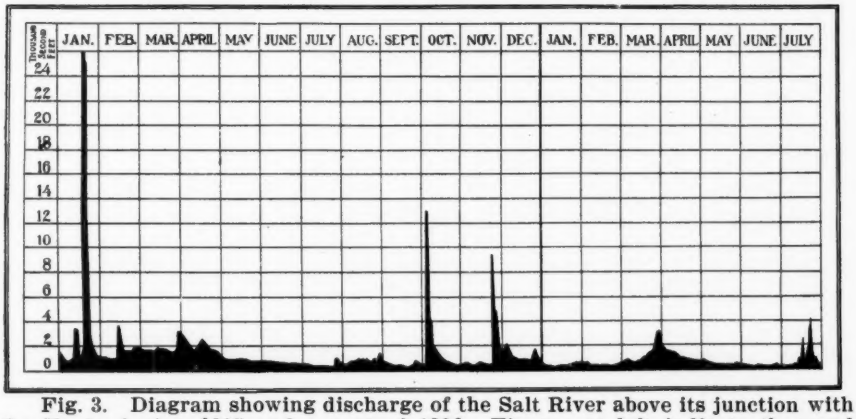

Fig. 3. Diagram showing discharge of the Salt River above its junction with the Verde during 1895 and a part of 1896. Figures at left indicate thousand second-feet. (After A. P. Davis.)

15,000 second-feet. The mean discharge of the river in 1893 (at the site of Roosevelt Dam) was more than four times that of the preceding year and more than three times that of the following year. Such conditions made irrigation very uncertain. Most of the old diversion dams in the river were temporary affairs built of brush and rock; frequently they were swept away by floods. At such times they could not be repaired until the river had again reached a low stage, and then there was little water for irrigation. Encouraged by occasional years of relatively large water supply, the settlers increased the area under irrigation to such an extent that in drier years much farm land could not be watered. There was an insufficient supply of water during much of the decade 1890-1900, and during that period some farm land reverted to desert. Stable conditions and further agricultural development could come only with the construction of storage reservoirs and the utilization of flood waters.

The Salt River irrigation project was one of the first of the thirty government projects now under way which was decided upon after the passage in June, 1902, of the National Reclamation Act. This act provides that money derived from the sale of public lands in the arid states shall constitute a reclamation fund. The cost of any given project is assessed against the land benefited, and is paid by the settlers in ten annual payments. The moneys returned to the government, together with the proceeds of the sale of other lands, are used again for further reclamation. The site chosen for the Roosevelt Dam (Fig. 4), the principal feature of the Salt River project, is in the narrow canyon of the Salt River, just below its junction with Tonto Creek and about 75 miles northeast of Phoenix* (Fig. 1).

Geographic conditions made the construction of the dam difficult in many ways. Its successful completion was a notable achievement, for few if any kinds of engineering work require greater care and skill than the building of a large and permanent dam across a torrential river. The site of the dam is in a rugged and nearly uninhabited region, 60 miles from the nearest railroad station to the west (Mesa), from which food stuffs, hay, grain, machinery, etc., were hauled by wagon. To make this possible, a road was constructed with difficulty to the site of the dam. In places in the mountains, cuts 60 to 70 feet deep in the solid rock of nearly vertical cliffs were necessary, and at other points rock-fills 75 or more feet high were required. Some sections of the road cost $25,000 a mile. Large quantities of lumber, brick, and cement were required for the work, but the long wagon haul made the cost of bringing such materials from outside prohibitive. Accordingly the Reclamation Service manufactured these things near the dam. A sawmill was erected in the Sierra Ancha, some 30 miles from the dam, and timber owned by the government was used to manufacture the needed lumber. Clay and limestone occurring near the site of the dam, a Portland cement plant was built, in which some 340,000 barrels of cement were made. The cement was transported from the mill to the site of the work on an aerial tramway a third of a mile long. To obtain a supply of sand, it was necessary to quarry and crush sandstone, for the only natural sand in the vicinity was in the bed of the river, where it was inaccessible during floods. A large amount of power was needed for the auxiliary plants and for the construction of the dam. Wood, the only local fuel, could not be used economically, and the cost of transportation precluded importing large quantities of coal or oil. Oil which cost 19 cents a barrel at Bakersfield, California, cost $3.48 a barrel at the site of the dam. Accordingly, a hydro-electric system to develop 4,400 horse-power was constructed. Water from Salt River is turned into a power canal by a diversion dam located some 19 miles above the Roose-

*The sites of the dam and the reservoir are shown on the Roosevelt, Arizona, topographic sheet of the United States Geological Survey.

velt Dam. The power canal, which has less grade than the river, conveys the diverted water to a point near the Roosevelt Dam, from which it descends 220 feet in an inclined penstock tunnel in the walls of the canyon to turbines located in a power house just below the dam. Offices, warehouses, work shops, residences for engineers and other employees, a hospital for the benefit of laborers, and other buildings were constructed, together with lighting, water, and sewer systems for the temporary town which grew up on the floor of the future reservoir as work progressed. Common labor was not easy to get, partly because of the distance from other towns and the regulations (such as the exclusion of saloons) enforced by the government. The problem was solved in part by employing several hundred Indians, descendants of the Apaches who, from their mountain retreats, had warred upon the early

Fig. 4. Roosevelt Dam, in the canyon of Salt River. The strata in which the canyon is cut dip toward the reservoir, a condition which helps to retain the stored waters and adds to the stability of the dam. (Phoenix Board of Trade.)

settlers of the region. The sandstone for the dam was quarried from the neighboring walls of the canyon, and the first masonry was laid in September, 1906. In spite of many delays during the earlier stages of the work, due to repeated floods in the river, and in spite of the difficulties already referred to, the great dam was completed in February, 1911. The Reclamation Service had furnished some water to irrigators since 1907.

Roosevelt Dam is 280 feet high, 235 feet long at the bottom, 1,080 feet long on top, and contains 342,000 cubic yards of stone and cement. At each end of the dam there is a spillway 200 feet long and 220 feet above the stream bed. These spillways were excavated from the walls of the canyon, and are spanned by great arches of re-enforced concrete which support roadways connecting with the 16-foot roadway along the top of the dam. The reservoir controlled by the dam has an area of 16,320 acres (Fig. 1), and a capacity of 1,284,000 acre-feet. The waters in the reservoir form a beautiful lake, called Lake Roosevelt. Most lakes are being destroyed slowly. Sediment washed into a lake from the tributary slopes displaces an equal volume of water, and if continued long enough, deposition will fill the basin and obliterate the lake. Sedimentation in Lake Roosevelt, though rapid, is reduced by the fact that many of the tributary slopes are timbered and are within the Tonto National Forest, where grazing is regulated. Both the trees and the partial cover of grass reduce soil wash. It is estimated, however, that the

Fig. 5. An irrigated field of alfalfa in the Salt River Valley. (Phoenix Board of Trade.)

reservoir will be nearly filled with sediment in 200 years. In time, therefore, sediment must be dredged from the lake, or the dam must be built higher. One of the outlet tunnels extends from near the bottom of the reservoir, around the south end of the dam through the walls of the canyon, to the river bed below. The waters issuing through this tunnel carry out

some of the silt from the bottom of the reservoir, and so retard the filling of the latter. Another outlet, at the north end of the dam, takes water from a higher level in the reservoir, and conveys it to a 260-foot rock tunnel. The water escapes on the side of the canyon below the dam, forming attractive falls (Fig. 4). A third outlet takes water from the reservoir at a point some 65 feet above the bottom, and carries it down to the power house below the dam, where it is utilized for power purposes before being discharged into the river.

The water taken from the reservoir flows down the channel of the Salt River for 40 or 50 miles before reaching the mouth of the canyon and the edge of the aggraded plain. Together with most of the water which is brought to the Salt by its tributaries below the Roosevelt Dam, it is then turned through huge head gates into canal systems on both sides of the river by the Granite Reef Diversion Dam. This structure is 38 feet high and about 1,100 feet long, and is located a few miles below the mouth of the Verde River (Fig. 1). More than $10,000,000 have been expended on the storage works, power system, diversion dam, and canal systems.

The irrigable area in the Salt River Valley is limited by the supply of water, and covers about 230,000 acres. Approximately 190,000 acres can be irrigated by the gravity system of canals already noted, and it is believed that 40,000 acres can be supplied with water pumped from porous beds which underlie parts of the plain. By pumping, water also will be supplied for 10,000 acres on the neighboring Gila Indian Reservation. More than 550 miles of canals are now in use, with capacities of from less than 50 second-feet to more than 800 second-feet. In 1911 more than 150,000 acres were irrigated. To accomplish this, 689,000 acre-feet of water was turned into the canals.

Agriculture in the Salt River Valley is both intensive and diversified. Winter temperatures being relatively high, irrigation is carried on throughout the year. The Reclamation Service furnishes water under rental contracts at the rate (1910-1911) of $0.60 per acre during the summer season (June 1 to September 30) and $1.00 per acre during the winter season (October 1 to May 31), when most water is required. Most of the soils of the irrigated area are rich in mineral plant foods; they were formed from the varied rocks of the neighboring uplands, and ground-waters, coming to the surface through capillary action and evaporating into the dry air, have deposited in them the mineral matter dissolved during their journey underground. The high value of the irrigated lands encourages methods of tillage which secure maximum yields from minimum areas. More than half the cultivated area is in alfalfa (Fig. 5), which is cut five or six times a year, and more than a third is used in growing grain, chiefly barley. The remainder is devoted to a wide range of products, including sugar beets, cotton, semi-

tropical fruits, and vegetables. Delicious dates are grown near Phoenix, and the industry promises to become an important one. Range cattle are fattened on the alfalfa, which also helps to support an important dairy industry. An interesting industry is the raising of ostriches; the birds are turned loose in the alfalfa fields, and are said to be handled in much the same way as cattle. A beet sugar factory and a number of creameries use characteristic products of the surrounding farms, and illustrate how raw materials of certain kinds determine the approximate location of the manufacturing plants which use them.

The hydro-electric power developed in connection with the irrigation project will be an important factor in the industrial life of the region, for the latter is far from productive coal fields. A total of 18,000 to 20,000 horsepower can be developed—9,000 at the Roosevelt power plant from the power canal and reservoir, and the rest at points along the river and at drops in the canals. Formerly, the power developed at the Roosevelt Dam would have had little value following the completion of the storage works, for the industries using water power had to be located close to the source of the power, and transportation and other conditions would prevent the establishment of industries at Roosevelt. During recent years, however, there have been rapid developments in the transmission of energy in the form of electricity, and now a water power, if sufficient, can serve an area of 100,000 to 125,000 square miles. About a third of the power developed in connection with the Salt River project will be used to pump ground-water for irrigation, and the rest will be sold to manufacturers, mining companies, farmers, and others. More than a year ago 123 miles of transmission lines were in use. Electricity generated by the hydro-electric power plant at the reservoir runs street cars, lights buildings, and is used for other purposes in Phoenix, 75 miles away. The sale of this power will in time repay the cost of the irrigation works.

With the beginning of the Roosevelt Dam, the Salt River Valley entered upon a new era of prosperity. This fact is reflected in various figures recently issued by the Bureau of the Census. Thus, the average value per acre of farm land in Maricopa County, within which most of the irrigated land lies, increased from $30.56 in 1900 to $104.50 in 1910. During the same period the value of all farm property in the county increased from $8,214,002 to $33,879,281, and the population from 20,457 to 34,488. The population of Phoenix, the business center of the irrigated district, increased from 5,544 in 1900 to 11,134 in 1910, and is said now to exceed 18,000. Had the Roosevelt Dam not been built, the admission of Arizona as a state might have been delayed for years. It makes possible one of the garden spots of America, in the midst of a desert.

SALT

By C. L. DAKE,

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NEARLY all rocks contain sodium in small quantities, in combination with other rock elements. When sodium-bearing rocks decay, the sodium, on account of its ready solubility, is one of the first elements to be contributed to circulating waters. Combining with chlorine, it forms common salt. Much common salt exists in sedimentary rocks, and is contributed directly to circulating waters. By rivers it is carried down to lakes or to the ocean.

When rivers flow into lakes that have outlets, whatever salt is carried to the lake is carried out again by the out-flowing stream. But in lakes with no outlet, and in the ocean, where there is little loss of water except by evaporation, salt is constantly being added and none removed. Since practically all rivers carry extremely small amounts of salt, in the course of time the ocean and most undrained lakes come to be very saline. When sufficiently salty to be perceptible to the taste, such lakes are spoken of as salt lakes. These lakes usually contain other salts in addition to common salt.

The salinity of various well known bodies of water is tabulated below:

	% Common Salt	% Total Salts
Mississippi River at Memphis	.002	.02
Atlantic Ocean	2.790	3.63
Great Salt Lake	12.000	14.99
Dead Sea	8.030	22.30

When the degree of concentration becomes so great in these bodies of water that they can hold no more, salt will be deposited; just as brine, by boiling, leaves a crust of salt on the bottom of a dish. It is only in basins where evaporation is excessive that waters become concentrated enough for salt to be deposited. Such conditions are usually found only in arid regions, in undrained lakes and in arms of oceans or seas where evaporation is greater than river or spring supply, so that salt water from the open ocean or sea flows in to replace the excessive loss.

Many places are known where the less soluble salts are now being so deposited. In certain bays of Great Salt Lake, and in many smaller lakes of the Great Basin, salts are now being laid down. Before the Salton Sea in southern California was flooded by the Colorado River, as high as 29 inches of salt was deposited daily during the dry season, most of which was common salt. Karaboghaz Bay, an eastern arm of the Caspian Sea, evaporates so rapidly that salt water from the main lake is constantly flowing in to make

up for the loss. The concentration is so great that no life exists in the water, and the less soluble salts are being precipitated, though as yet it is not saline enough for common salt to be deposited.

At seasons of flood, when rivers carry much sediment, the salt layers on the bottoms of the lakes or bays may be buried beneath layers of mud or sand. More salt may then accumulate as before, and again mud and sand be washed in, until the salt is buried to a depth of hundreds, or even thousands of feet. The sands and muds solidify into rocks and later uplift of the land, and erosion by rivers may expose the salt, as layers in the rocks, or they may be found by deep drilling. Such salt layers are common, and are worked extensively in New York, Michigan, Kansas, and other states, and in many foreign countries. Often, many beds lie one above another, separated by layers of rock. In New York and in Kansas beds of solid salt over 300 feet thick have been discovered, and one at Sperenberg, Germany, is known to be over 3000 feet in thickness.

It may also happen, as in the peculiar "Domes" of Louisiana, that water which seeps through salt beds at great depth may find its way toward the surface along cracks in the rocks, and fill these with salt which it deposits on its upward way. Sometimes the force of the growing salt crystals may arch up the overlaying rocks into "Domes."

From deep beds, salt is secured in two ways. In New York, shafts have been sunk into the salt beds and it is mined like coal. But this underground method is employed more commonly in Europe. At Wieliczka, in Austria, about 1608 A. D., was opened up what is even yet the largest salt mine in the world. It is 984 feet deep and extends 300 feet below sea level. In the mine are over 25 miles of railroad, converging at a central station carved entirely out of solid salt. In an enormous ball room, the walls and ceilings of which glitter with salt crystals, many royal fetes have been held. Over 1200 miners are employed in the mine. Such underground mines, however, are rare. In the majority of cases wells are drilled through the overlying rock, and water is forced down into the beds and dissolves the salt, which is then pumped up in the form of brine and is evaporated either by the heat of the sun or over fires.

It also happens, as at Onondaga Lake, New York, and in many other places, that underground waters seeping through the salt beds come out at the surface as natural brine springs, whose waters are evaporated as in the previous case.

At a few localities about Great Salt Lake and San Francisco Bay, the salt waters are allowed to flow into shallow artificial basins, in which they can be completely shut off from the main body of water. These are allowed to stand until the sun's heat has evaporated the water, leaving a layer of salt. This process is much more widely employed in Europe than in the United States.

In nature, salt beds contain from one to ten or fifteen percent of impurities, which must be removed by a process of refining. If the impurities run higher than this, the salt is not often used.

Salt is used most widely in meat-packing, in dairy products, and for household purposes. It is also used in the manufacture of various chemicals, and large quantities are consumed in the extracting of gold from its ores. New York, Michigan, and Kansas, in the order named, are the largest producers in the United States. We also import some salt.

In many countries, notably Venezuela, Ecuador, Peru, Italy, Austria, Japan, Greece, and Turkey, salt is a government monopoly. The mines are either leased to private individuals or operated by the state. In many of these countries the importation of salt by private individuals is forbidden under heavy penalty. In Austria, when leaving the mines, miners are searched for concealed salt, which is about fifteen times as expensive there as in the United States. In Abyssinia it serves as money, and in central Africa it is so scarce that fathers will sell their children into slavery to secure it. In many parts of Africa plant-salt is used, made by dissolving out the salt from the ash of various trees and grasses.

Authorities:

Clark, L. W., *Data of Geochemistry;* Bull. U. S. Geol. Survey, No. 491.

Ries, Heinrich, *Economic Geology of the United States.*

Harris, G. D., *Rock Salt;* Bull. La. Geol. Survey, No. 7.

CONSERVATION OF IMPORTANT GEOGRAPHICAL AREAS FOR EDUCATIONAL PURPOSES

By ZONIA BABER,

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AT present there are only two places in Holland where natural vegetation can be seen.

The United States has taken warning from the mistakes of older countries, and set apart certain sections for national parks and for forest reserves. These regions, however, are so distant from the majority of our people, they can only be used by those who have sufficient means to spend their holidays in these delightful places. For this reason every section of the country—every city, township and county containing features of special aesthetic or educational value should preserve them for all time as the birthright of posterity.

The Geographic Society of Chicago realizing the importance of certain areas in Chicago and its environs for field work, appointed a conservation committee, with the hope of saving these valuable regions. It does not take a great seer to prophesy that in the not far-distant future there will be few if any natural features remaining around the south end of Lake Michigan from Waukegan to Michigan City.

There are still a few regions of special value to the students of geography, geology, botany and zoology that have been but slightly injured by the encroachment of man; unless these regions are conserved in the very near future, they will be destroyed forever for educational purposes. The story of Chicago has been or will be repeated in every thickly populated area in this country. And what region may not be densely populated? To avoid the fate of Holland we should begin now while it is possible to save our most valued areas.

North of Chicago bordering on Lake Michigan is a tract of ravine-dissected glacial drift which is an ideal place for the study of the formation of valleys, the materials of the moraine, and the work of waves. For fifteen years students in the departments of geology, geography, and botany in the University and public schools of Chicago have made constant pilgrimages to this region. Now, however, private ownership informs the student that trespassing is prohibited.

The conservation committee of the Geographic Society, hoping to secure a ravine that would be open to students for all time, found on investigation, that the price of a ravine was far in excess of the amount of money the society could hope to secure. One far-sighted man of commerce said: "You have come too late. You should have thought of this ten years ago. Now every foot of this land is worth two hundred dollars."

Now we must go farther north, to Fort Sheridan, to find an accessible ravine, adding to the expense of the trip in both time and money.

Another important area sacred to the nature lover and student out of school as well as in school, is located at the south end of Lake Michigan in Indiana. Here is an area of sand dunes of unusual importance for educational purposes. Indeed, if this wonderful phenomena were to be seen only in the desert of Sahara, hundreds of our people who do not know their own wealth of landscape, would journey to Africa to gaze on this marvel of nature. For the study of wind action, there is no better place in the world than Dune Park, Indiana. For the study of adaptation of plants to rapidly changing conditions there is no better place; for the study of animals, especially of swamp life, and birds, this region offers excellent opportunities. But even in this sand-swept area, through the establishment of immense industrial plants and the advancement of population, forces are at work which are

rapidly making this great laboratory of nature a story of the past. Effort is being made to have a certain tract of the dunes reserved as a state park.

There is another region greatly prized by the teachers of physiography, geology, and botany, which begins at the Sag, located twenty miles southwest from the center of the city, and extends down along the Desplaines River. Here not only the glacial drift that mantles the country but the underlying rock have been eroded by the tributaries of the Desplaines River, forming canyons in the limestone. The best examples have been commercialized and ruined for purposes of education. In fact but one small canon at the Sag is now accessible. The Geographic Society found on investigation that this canyon cannot be purchased at present as the land is in litigation, on account of the construction of the Calumet canal through this region.

A few persons are sufficiently conscious of the perspective of true values to witness with sadness the destruction of a live tree that has taken a hundred and fifty years to develop its beauty. They feel that its downfall is a crime not against the living alone, but also against posterity.

The American conscience has been aroused to the value of the sequoia of the Pacific Coast, so that the trees that have taken from two thousand to two thousand five hundred years to attain their enormous size are now protected, but only after large areas of those wonders of nature have been destroyed. The giant sequoia is but an ephemeral growth in comparison with the time necessitated in the creation of certain unique landscape features found in every neighborhood. Some of these have been taken thousands and others millions of years in the making. If a great redwood tree is destroyed it may be replaced by waiting a few thousand years; but if the record shown at Stony Island, of the work of the glacier that held dominion over this region for thousands of years were destroyed, it can never be replaced for the inhabitants of Chicago.

Stony Island is a fold of limestone rising twenty to twenty-five feet above the surrounding swampy plain, located at Ninety-third Street and Stony Island Avenue. Many million years ago it was a beautiful coral reef displaying wonderful shades of purple, green, yellow, brown, and pink in the warm clear waters of the Silurian Sea. Storm waves dashed against the reef and rolled the broken coral, shells, and other limy deposits, back and forth, reducing it to sand and clay, depositing it upon the reef and the adjoining ocean bed. These sediments, together with the coral and the remains of other sea life, were cemented together, forming the interesting limestone of this region. Some time during the eons that elapsed after this was the home of the coral polyp, lateral pressure forced the region into a fold, evidence of which is found in each of the two old quarries in the western part of Stony Island. If we assume we have measured the same layer on either side of the "Island," and try to reinstate the fold from the angle of dip, we find it would rise 772 feet above the present surface of the plain. It appears

then, that we have here but the stump of a very respectable mountain. This evidence of folding is the only example of mountain making to be seen in this part of the country.

When the glacier passed over Stony Island, it polished and scratched the limestone with the fragments of stone borne in the bottom of the ice; this is the best example of striae on bed rock to be found in this part of the country.

Stony Island is as unique in its vegetation as in its geology; were it to be destroyed or even changed, the many beautiful and rare plants now growing abundantly within easy access of the people of Chicago, could be seen only by making a journey of many miles. It would be a serious error on the part of the city to fail to add the most interesting part of Stony Island to our park system, thus saving it from inevitable destruction by the encroachment of residences or factories.

A clever real estate man when asked why the industries show so much foresight in choosing locations, leaving the people to make the best of the poor, unattractive regions replied, "Men have specialized in the various industries, but no one has specialized in people." Is is not time to begin to specialize in people?

If the geographers and other scientists throughout the country will select the areas of greatest educational worth in their respective localities and educate the community to the point of conserving them, they will form an educational bank account for posterity which cannot be estimated.

"The earth is the Lord's and the fullness thereof" may have been true when the twenty-fourth Psalm was written. But real estate has changed hands since that time. And the Lord's children deeply interested in the places of the earth which most clearly "showeth His handiwork," and believing they are joint heirs to the aesthetic and intellectual riches of His kingdom, are very much chagrined to be treated as trespassers, when all they take from the landscape is knowledge. Is it not a forged deed that lays claim to the clearest and best pages of the book of nature, those pages which contain the fullest record of the history of the earth? It is the obsession of commercialism that blinds us to real values.

When shall we hold sacred this wonderful book, and cease our ruthless tearing of its leaves?

The geography department of the Milwaukee State Normal School has added another member to its teaching force this year. It has secured as junior member Miss Louise Mears, head of the geography department of the Peru, Nebraska, State Normal. Miss Mears has already instated herself in her new environment by becoming a charter member of the Wisconsin Geographical Society and a member of the Wisconsin Academy of Sciences.

THE MILK SUPPLY OF CHICAGO

By MARION WELLER,

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AN examination of reports* on the production of milk for some of our large cities, shows that the fight for pure milk has brought results, but that there is still much to be desired in the way of cleanliness both on the farm and in the method of handling the milk after it leaves the farm. It further shows that in each city and its milk-producing territory local peculiarities in the conduct of the business have developed. In the following paragraphs will be stated the conditions peculiar to the management of the milk supply of Chicago.

Production of most of Chicago's milk within 60 miles of the city is in marked contrast with the conditions in Boston, where the supply is produced outside a 50-mile circle, some of it coming 200 miles; and in New York where little milk is produced within 50 miles and some comes from points 400 miles away.

It is estimated that the daily consumption of milk in Chicago is probably not far from 1,000,000 quarts. The supply comes from approximately 120,000 cows, and 12,000 farms located in 11 counties of Illinois, 8 of Indiana, and 5 of Wisconsin. Three-fourths of the supply is produced in Illinois, and more than one-half of this in McHenry and Kane counties. McHenry county is the third largest milk-producing county in the United States, and Kane county the fourth.

It is interesting to note that production has extended toward the northwest more than in other directions. Thus, nearly two-thirds of the supply comes into the city over two railroads, the Chicago and Northwestern, and the Chicago, Milwaukee and St. Paul, most of it in transit only two or three hours. The freight rates are not uniform but the dealers estimate that the freight costs, on an average, three-fourths of a cent per quart.

The milk sold in New York city is handled mostly by large dealers who own the shipping stations in the country, and who are therefore the receivers, wholesalers, and retailers all in one. In Chicago there are two types of

*Bul. 138, Bureau of Animal Industry, U. S. Dept. of Agriculture, ***Milk Supply of Chicago and Washington.***

Reports and Bulletins of the Department of Health, Chicago.

Bul. 120, Univ. of Ill., Agric. Experiment Sta., ***Milk Supply of Chicago and 26 other Cities.***

Bul. 81, Bureau of Animal Industry, U. S. Dept. of Agriculture, ***Milk Supply of Boston, New York and Philadelphia.***

dealers, the large dealers doing business in one way, and the small dealers in another. It is estimated that two of the largest dealers do one-third of the city's business.

The large dealers own and operate milk stations or bottling plants in the country, to which the producers bring their milk. These stations are located on the railroads and serve the farmers within a radius of from 4 to 5 miles. Every morning long lines of spring wagons loaded with milk cans which are covered over with canvas, may be seen leading to the receiving platform of the station. The milk delivered is the milk of the morning and the previous evening. It has been cooled to 60° F. by placing the cans in tanks of well water. The cans are owned by the farmer and each holds 32 quarts.

When the milk has been emptied from the cans into the receiving vat, the cans are passed on to a room where they are washed and put through a steam bath. They are then returned to the owners. The milk is weighed, passed on to the milk room, mixed, cooled, bottled and generally pasteurized. The bottles are then packed in crates for shipment by the carload. In the summer they are iced in transit.

The milk stations differ greatly. All are well provided with facilities for cleansing and sterilizing the cans and bottles with steam. Some do only a bottling business. Some have condensing plants and, when there is a surplus of milk, do a large condensing business. Many of the stations have cream separators and are equipped for making butter and for furnishing buttermilk for the market.

These plants are owned by large corporations with money and reputations at stake. Consequently they are quite generally constructed and operated in a sanitary way. They are equipped with modern plumbing and machinery, and many have cement floors and tiled or enameled walls. The companies have regulations looking to clean, pure milk, and employ inspectors to see that these regulations are complied with at the dairies and at the milk stations. This inspection is in addition to official inspection.

The city plants of the large dealers consist only of offices, laboratories, and stables. Facilities for handling milk are not required, because the bottled milk, which reaches the city about midnight from the country stations, is unloaded on platforms which are controlled by the dealers, and transferred directly to the waiting wagons.

From one to four carloads of milk, cream and buttermilk leave each milk station daily. This milk is delivered in the better residence districts of the city. It is uniformily up to grade in butter-fat. Tables issued for the summer of 1906, show 9 per cent of the milk below grade and not free from sediment. This would indicate that conditions were not perfect at all sources of supply.

It seems beyond doubt that about one half of the milk sold in Chicago is fairly satisfactory; that is, it is up to grade in butter-fat, is practically free from sediment, and the bacterial count is relatively low. This cannot be said of the milk handled by the small dealers. Under pressure brought to bear by the department of health in the enforcement of city ordinances, conditions have, however, been gradually growing better, and there is a constant tendency among the small dealers to go out of business.

The producers whose milk goes to the small dealers are called "shippers." The shippers deliver their milk in 32-quart cans at the local railway stations, where it is collected by the milk trains between six and eight o'clock in the morning. The cans are required by law to be sealed. They carry the milk of that morning and the previous evening, and reach the city about nine o'clock. The dealers transfer the cans in wagons from the railway platforms to their places of business, where the milk is immediately cooled. The farmers usually cool the night's milk somewhat, but there is no refrigeration in transit. In the afternoon the milk is bottled and placed in ice water ready for the morning delivery. In the smallest places of business no bottling is done, but the milk is sold to the customers from the can. A city ordinance now requires that the milk be poured through a spout and not dipped from the can when sold in this way.

Occasionally the milk depots are clean and sanitary, but it is the exception. They are of every grade. At one extreme is the thoroughly up-to-date establishment with modern bottling machinery, pasteurizer, separator, and churn. At the other extreme is the depot located in a dark, dirty, ill-ventilated basement, with floors and walls always damp and filthy.

The poorer districts of the city are supplied from these depots. Tables show over half the milk sold in some districts to be below grade in butter fat, and with a large amount of sediment. Not only is the milk handled in an unclean way, but before taking milk from a can much of the cream is removed to be sold separately. The milk is watered and sold as whole milk. Most of this milk is up to grade in butter-fat when it comes to the city. It is noticeable that the poor people who need the best nourishment pay almost as much for poor milk as the rich people pay for good milk.

It was customary for a long time for bakeries and provision stores in some parts of the city to sell "can" milk, often at a figure below the wholesale cost, as an advertisement for their business. Not only was the milk found to be adulterated but it was handled in an extremely unsanitary way. These stores were in districts having the highest infant mortality. A city ordinance now allows only bottled milk to be sold from stores.

The laws controlling the milk supply in Chicago are city ordinances. In 1908 the city council passed an ordinance providing that all milk sold in the city should be from cows that had satisfactorily passed the tuberculin

test, but allowed pasteurization as an alternative for 5 years. After much opposition this ordinance went into effect January 1, 1911. During the last session of the legislature a state law was passed declaring it unlawful for cities to require the tuberculin test of cattle employed in the production of milk, consequently the city ordinance, including the clause referring to pasteurization, became inoperative. Thus milk could be shipped into the city from any source and in any condition and sold, unless the city inspector happened to find it out.

A new ordinance looking to the protection of Chicago's milk supply was recently passed. It provides that all *raw* milk sold in the city shall be of a grade defined as "Inspected," and shall meet certain requirements. Eventually every bottle of milk sold in Chicago must bear one of two labels, "Inspected" or "Pasteurized."

A grade of milk known as "Certified," is produced by a few dairies. This is handled by the regular dealers, and is certified to by a medical commission appointed by the Chicago Medical Society. This milk is sold for several cents a quart above the price of ordinary milk.

The health commission has general supervision of the milk inspection. There are at present only 10 inspectors for the city work and 10 inspectors for the country service. There is still much to criticise in the inspection. Commissioner Evans himself said in 1910: "Chicago's milk supply is one of the dirtiest in the world." But steady progress is being made, ordinances are being enforced, and absence of preservatives is plainly noticeable in Chicago milk. It is believed that the constantly decreasing death rate among babies is due to the fact that the milk is a purer and safer article of food than ever before.

AN EXAMPLE OF STORM EROSION IN THE BADLANDS

By S. S. VISHER,

University of South Dakota, Vermilion

BADLANDS are phenomena developed by stream erosion of a somewhat unusual type. It is sometimes said that badlands are developed by the erosion of rather soft shales in a semi-arid region where the precipitation is torrential. Though many, perhaps most, American geographers have seen badland topography, I think that few have witnessed a severe storm in such a region and therefore the following incident may be of interest.

It has been my pleasure to visit the badlands of South Dakota a number of times in the interests of the State Geological Survey. Though I have been in several rainstorms, I still had to take on faith, phenomena which now, because of the incident related below, it is no longer necessary for me to so

take. On July 5, 1911, the writer, in charge of a small party of the State Survey left Kadoka, crossed the White River, entered the badlands which form the southern bluffs and commenced the climb out of the valley. The only possible trail out of the beautiful badland basin which we had come across was up a canyon which for about three miles had precipitous sides. Ordinarily a small stream, fed by springs at the contact between the White River and Rosebud formations, trickled the full length of the canyon. Because of the recent drought we had to ascend about midway up the gorge before a supply of water could be obtained. The approaching darkness and lack of familiarity with the road persuaded us to camp there in spite of the recognized risk. The site of the camp is shown in Fig. 2.

Figure 1

Two months later I returned alone to this "Cottonwood Canyon" on horseback and it was well that it was not with the team. The canyon was scarcely recognizable. The smaller trees and all the shrubs were gone from the bottom; the larger trees were broken or badly scarred and stripped of branches up to a height of as much as twenty feet; the sediment was in many places washed entirely away, exposing the shales as the floor of the canyon. Two bridges of pine timbers twenty feet long and 2½ feet in diameter were washed away and one of the logs was found beyond the mouth of the canyon, over three miles below. The walls of the canyon were greatly altered. Where formerly the stream had been winding, it was now straightened; where great piles of talus had been, now there was a clean cliff. In a few places the erosion had widened the canyon by yards if not rods.

Where our camp had stood the debris had been removed for a depth of over six feet and the channel then crossed the spot. The vegetation was positively all gone except the four largest trees shown in the photograph.

Needless to say I was glad the "cloudburst" had not struck the night of July 5.

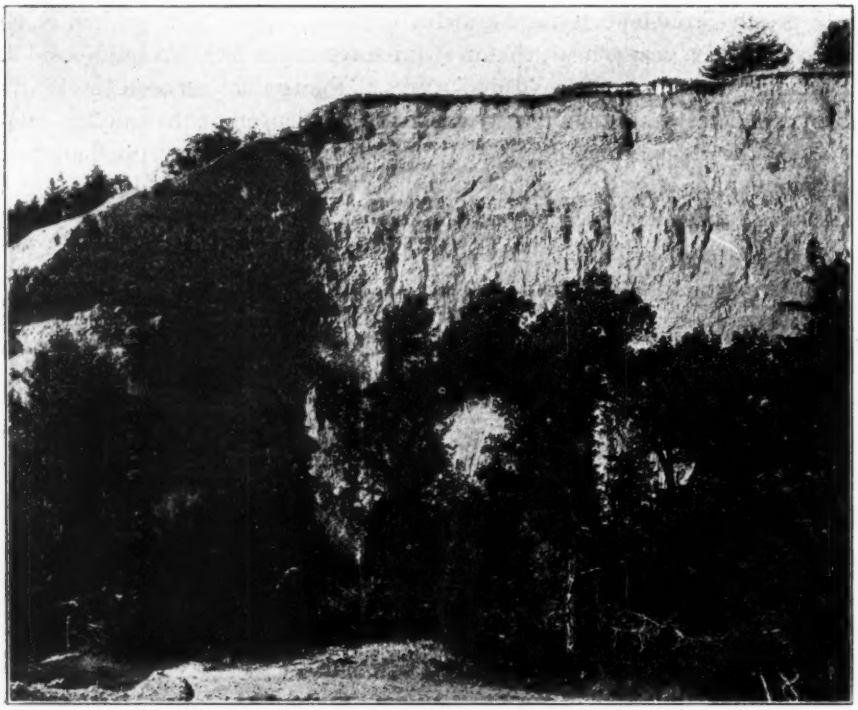


Figure 2

EXERCISES IN THE USE OF A SCHOOL ATLAS

By ANNIE L .WELLER,

Normal School, Charleston, Ill.

TEXT used: *Longman's New School Atlas.*
Continent to be studied: *South America.*
Aim: To teach map reading.

1. From the table of contents find out which maps will tell something about South America. Learn to turn to maps by using the index figures.

   Compare maps 2 and 3 as to form. Meaning of *map-projection?* Aids in the understanding of map-projection:

   1. The projection lantern.
   2. Imagine a screen on the wall, the globe of glass with the eye at the center projecting the pictures on the globe upon the screen. The Mercator, conical, orthographic, stereographic and globular projec-

tions may be simply explained by merely changing the position of the eye or of the screen.

The advantages and disadvantages of each? Where in each is there exaggeration?

Explain the colors used in map 3. Use of legend in upper corners of page?

2. A STUDY OF MAP 2.

The following illustrate the things which may be learned about South America from map 2.

Size, relative to other continents.
Position in latitude and longitude.
Depth of the ocean about it; width of continental shelf.
Character of the coast line.
Distribution of highlands and lowlands.
Height of the land.
Direction of slopes.
Location of volcanoes.
Location of principal rivers.

3. A STUDY OF MAP 3. (Use legend in lower left hand corner.)

Direction from other continents.
Direction and rate of flow of ocean currents and drift which affect South America.
Distribution of rainfall through the seasons.
Location of coral coasts.
Limits of drainage areas.
Location and names of the large cities.
Islands near to South America.
Could comparative size be told from this map?
Account for region of minimum rainfall.
Why winter rains on the southwest coast?
If ocean currents have not been studied, they may be presented, simply, in this exercise.

4. A STUDY OF MAPS ON PAGE 4.

Name of projection used.
Distribution of temperature for January. Why warmer in the north than in the south?
Distribution of temperature for July. In which month does South America have its highest temperatures? Why?
The annual range of temperature for the Amazon Valley? for Tierra del Fuego? Why greater in the latter place?
Compare the temperatures and range with those in North America, using for comparison, places of the same latitude in the two hemispheres.

What is the yearly average temperature for the Amazon Valley? For Tierra del Fuego? Why greater for the latter?

Compare with places of the same latitude north, in North America. Account for differences.

5. A STUDY OF MAP 5. ISOBARS.

The name of the projection.

The distribution of air pressure for January.

Compare with distribution for July and explain.

Compare pressures over continent and oceans in January and explain.

Wind directions for January and July.

Relation of wind directions to air-pressure.

Shifting of wind belts.

6. A STUDY OF MAPS 6 AND 7. RAINFALL AND VEGETATION.

Distribution of rainfall, map 6.

By using maps 2 and 5 account for regions of heavy and of scant rainfall.

From map 7 locate regions of tropical forest, arid and semi-arid regions, grassy regions, and regions with the temperate zone type of forest. Account for their distribution.

Account for location and changes in direction of the lines denoting the limits for palms, cereals, trees.

7. A STUDY OF MAP 8.

The distribution of population in South America.

Account for the greater density in regions marked 2.

What races inhabit South America? Relate to history.

Account for the distribution of peoples and religion.

8. A STUDY OF MAP 18. PHYSICAL MAP OF SOUTH AMERICA.

Make a list of all the facts you can find out or reason out from this map of South America, using no other map.

A series of exercises similar to these could be worked out from any good text book and should lead to a thorough understanding of the fact that to read a map includes reasoning as well as observation work.

NEWS ITEMS

A Notable Field Trip in High School Geography.

In the March School Review Mr. George J. Miller of the University High School, Chicago, gives an account of a rather unusual field trip which he conducted last summer. Only excerpts are given here. THE JOURNAL OF GEOGRAPHY congratulates Mr. Miller on this work.

"For several years I have conducted local field work with my classes, but always felt the need of more extended work. During the past five years there have been many enthusiastic field students in my classes. and they have frequently suggested that a long-distance trip be taken to study many of the interesting things about which they had read but which they could not study at first hand. This suggestion with a definite plan of execution was presented to Principal Franklin W. Johnson, of the University High School, and met with his hearty approval. The entire cost was met by members of the party. The result was the establishment in the University High School of a distinct course in field geography, open to any boy in the school, and offering a half-unit credit. To assure a party, and lessen the individual expense, boys not seeking credit were admitted. Contrary to the opinion of some, this plan added to the interest of the whole party, rather than detracted from it."

"The trip, therefore, aimed first to accomplish a successful course in field geography, including the constant use of topographical and geological maps and such instruments as the compass and aneroid barometer, but at the same time secured vigorous, healthy out-door exercise in the pure mountain air. The region selected was the Jackson Hole country of Wyoming and the Yellowstone National Park. The journey to this region offered an excellent opportunity to study the climatic change from the moist Chicago region to the aridity of Utah and Idaho."

"The party left Chicago in a special sleeping-car attached to the regular train. This car was used exclusively by the party throughout the entire rail journey. The route followed led through Omaha, Denver, Royal Gorge of the Arkansas River, across the Rocky Mountains by way of Tennessee Pass, Salt Lake City, and to St. Anthony, Idaho. Stops were made at Denver and Salt Lake City. At St. Anthony traveling clothes were exchanged for field clothes, each boy was provided with a saddlehorse, and the 500-mile journey overland began.

Provisions for such a journey must be carried from the start, and together with camp equipment and personal baggage require several four-horse wagons, the number required varying with the size of the party. Last season the party consisted of 15 boys, 2 instructors, and 6 employees. Twenty-seven horses were used besides a few extras hired to help over especially bad roads.

A route was followed southeast from St. Anthony, crossing the Teton Mountains by way of Teton Pass and entering Jackson Hole near the southern end, thence north along the east flanks of the Tetons to the south entrance of Yellowstone Park. Several days were spent in camp and in making side trips in the Jackson Hole region. The first camp in the Park was on Lewis Lake, and side trips were made to Pitchstone Plateau, Heart Lake, and the Red Mountains, from which came most of the lava covering the sur-

rounding country. From this camp the party journeyed to Yellowstone Lake, Yellowstone Canyon, Mount Washburne, Tower Falls, Mammoth Hot Springs, Lower and Upper Geyser Basins, and other side trips were made to the crest of Gallatin Mountains and Shoshone Lake. After a last look at Old Faithful, the return journey was begun and the Park was left behind at Yellowstone, Montana. From this point the trip to Chicago was made by way of Pocatello and Cheyenne across the bad lands of Wyoming."

"I do not consider that I have solved the problem of field geography, but if the establishment of this course in the University High School has contributed toward its solution I shall feel that the effort has not been in vain. Nex season (1913) the same trip will be made during the early part of the summer with a second trip to Glacier National Park during the latter part. The latter trip will be made by pack train, as wagons cannot be used."

A local branch of the Wisconsin Geographical Society has been organized in Madison. The work outlined for the present year is divided into three departments,—

(1) Department of lectures
(2) Department of study courses
(3) Department of reading courses.

Under the auspices of the society two classes, primarily for the teachers of the city, have been formed; one for the study of the Geography of Europe and one for the study of the Geography of Africa. Other classes will be offered later. Field trips in the spring are a part of the program.

The June number of the *Journal of Geography* will be a Summer Travel Number. It will contain a series of short articles on the great scenic places of the country, such as Yellowstone Park, Crater Lake, Glacier National Park, The Yosemite Valley, The Royal Gorge of the Arkansas, The Petrified Forests of Arizona, The Mammoth Cave, The Grand Canyon, and perhaps other places. Each article will give information regarding ways of reaching the place, cost, etc., also a brief account of the geographical and geological features.

Four summer schools of geography will be held in England next summer, at Aberyswyth, Reading, Yorkshire and Cambridge. The latter may be of some interest to American teachers who travel in England. Dates, August 6 to 22. Fee £3 3s. A variety of attractive courses are offered.

Some of the recent magazine articles which are of especial interest to geography teachers are:

The Economic Resources of Chile, by Walter S. Tower, in the February *Bulletin of the Pan American Union,* Washington, D. C.

The Geologic History of China and its Influence upon the Chinese People, by Eliot Blackwelder, in the February *Popular Science Monthly.*

The Influences of Forests upon Climate, by Robert DeC. Ward in the April *Popular Science Monthly.*

It is announced that Columbia University will offer, each summer in the future, systematic work in physical and economic geography. There will be a course on Physical Geography and its Economic Aspects, given by Professor D. W. Johnson: also courses of a more advanced character on the Physiography of the Eastern United States, given in the even-numbered years, and on the Western United States in the odd-numbered years. These courses are for teachers and for general students. Laboratory and field work is included, with probable trips to the Adirondacks, Berkshires and the Appalachians of eastern Pennsylvania. In the Teachers' College, Dr. C. T. McFarlane, Mr. W. L. Vosburgh and Miss C. B. Kirchwey will give courses for teachers.

On Easter Sunday a handsome memorial window was presented to Cornell University by Mrs. R. S. Tarr, in memory of her husband, the late Professor Tarr. The presentation was made by Professor Lawrence Martin. The window forms one of the group of memorial windows in Sage Chapel.

During the coming summer Principal W. C. Miles of the Monticello, Wis., High School will take a class of his students to the Devil's Lake and Baraboo Mountains region for a week's field study. This is a kind of field work that counts. It will be a memorable event in the school lives of these young people. They will get as many new and definite ideas from one week in the field as from two months of book study. We hope other teachers may be inspired to follow Prin. Miles' example.

The University of Wisconsin will offer a four week's field course in Physiography and Geology during the month of August, immediately following the regular summer session. The region studied will center around Devil's Lake: the cost will be about $55.00. The course may be taken for 4 to 6 university credits. Prof. Lawrence Martin will be in charge.

RECENT PUBLICATIONS

Rand, McNally and Co., have recently brought out the volume on *Asia* in their set of GEOGRAPHICAL READERS. It is an attractive, illustrated, volume of 350 pages, written by Ellsworth Huntington. Professor Huntington's familiarity with a considerable part of Asia enables him to write graphically and interestingly on the people, customs and culture of the Orient. Seventeen colored maps add to the usefulness of the book. The au-

thor says that "The most important of all the principles which have played a part in determining the manner of the writing of this book is the conviction that ideas are the greatest of all human products."

The Macmillan Company has also just issued a supplementary geographical reader on *Asia,* one of their series on "THE CONTINENTS AND THEIR PEOPLE, by James F. and Arthur H. Chamberlain. It is a book of less than 200 pages, 19 short chapters. *Europe* and *North America* appeared earlier. The volume on Asia sells at 55 cents net. There is a profusion of illustrations of the type that children enjoy.

THE GEOGRAPHY OF MISSOURI, by Frederick V. Emerson, has recently appeared as part 4 of Volume I, Educational Series, University of Missouri. Part 4 is published as a booklet of 74 pages, 55 figures, and bibliography. There is a preliminary treatment of physiographic processes in general, followed by a discussion of The Physiographic Provinces of Missouri, Soils, Minerals, Climate, Settlement, Cities and Industries.

The little book is a valuable addition to our growing list of brief, authoritative treatises on the states, and will be welcomed. Professor Emerson's ability as an interpreter of geographical causes and consequences makes the treatment scientific according to modern standards. Copies may be obtained without charge by addressing the mailing clerk, University of Missouri, Columbia.

A LABORATORY MANUAL FOR PHYSICAL AND COMMERCIAL GEOGRAPHY, by R. S. Tarr and O. D. von Engeln has just come from the press of The Macmillan Co. It is designed for use in high schools, normal schools, and colleges. It contains 56 exercises, 214 pages, and represents an effort to connect laboratory work in geography more closely with industrial and economic matters. It is, to quite an extent, a manual in Applied Geography, and is in line with the pronounced present movement toward humanized geography. It begins to look as if we are to be provided with both text books and laboratory manuals of the type demanded by the friends of "General Geography" as distinguished from any specialized form of the study.

R. H.W.

THE SEA KINGS OF CRETE...This is a book which should be of interest to high school teachers of ancient history and of Greek, as well as to grade geography teachers who desire to make their treatment of the eastern Mediterranean alive and attractive. The author, Rev. James Baikie, has made a readable story of the archeological explorations in Asia Minor and Crete, in connection with Schliemann's discovery and excavation of the Troy of Homer's Iliad and the five preceding and several later cities of Troy, his discovery of the treasure at Mycenae and perhaps of the very bones of Menelaus and his family, the definite location and exhumation by other archaeologists of the Labyrinth of Daedalus at Knossos in Crete, and the finding of the pictures of ships that were used by the sea kings of Crete in their prime,

and of much regarding the civilization they developed. The stories are well told and grip the imagination. Published by Adam and Charles Black, London, 1913. Second edition, 274 pages, Macmillan Company, $2.00.

L. M.

MODERN GEOGRAPHY. This is a high school edition of Salisbury, Barrows, and Tower's Elements of Geography and follows the same plan (see *Journal of Geography,* Vol. XI, 1912-13, pp. 31-32). It is different from the high school physiographies of Tarr, Davis, Dryer, Gilbert and Brigham, and Salisbury and similar to the High School Geography of Dryer (see *Journal of Geography,* Vol. X, 1911-12, pp. 337-338). The book devotes 26 pages to Earth Relations and Relief Features, 107 pages to Climate, 20 pages to the ocean, 107 pages to physiography, and the remaining 138 pages to applied geography. The latter includes the uses and problems of inland waters; plains, plateaus, mountains, and coastlines and their relations to life; the distribution and development of leading industries of United States, the distribution of population, and the development of cities. The compression of the explanation of the origin of the surface features of the earth to a quarter of the book and the giving of a quarter of the total space to the atmosphere are features which make this book notably different from any high school text yet published. Henry Holt and Company, New York, 1913, 406 pages.

L. M.

SOUTH AMERICA...OBSERVATIONS AND IMPRESSIONS. By James Bryce. Pp. XXIV+612, with five maps. The Macmillan Co., New York, 1912. $2.50 net.

The book is the outcome of an extended trip to South America recently taken by the distinguished author in which he visited the republics of Panama, Peru, Bolivia, Chile, Argentina, Uruguay, and Brazil. Of the sixteen chapters the first eleven are, in general, devoted to a discussion of the scenery, the people, the relics of prehistoric civilization, the economic resources, the prospects for the development of industry and commerce, and the conditions of political life of the several countries visited, though not all of these points are necessarily taken up in the discussion of any one country. The last five chapters are devoted to "certain general questions affecting the whole Continent which present themselves to the traveller's mind and need to be discussed upon broad and general lines." These chapters are entitled "The Rise of New Nations," "The Relations of Races in South America," "The Two Americas and the Relation of South America to Europe," "The Conditions of Political Life in Spanish-American Republics," and "Some Reflections and Forecasts."

The errors due to the mechanical side are reduced to a minimum. The first line of the paragraph beginning on page 324 has the word "west" where it should have "east."

The book is one that holds the interest throughout. The author has a genius for observation, and he describes as well as he observes; the context is further enriched by many allusions of a scenic, historic, and literary nature drawn from his richly stored mind; and in the closing chapters there is given a sympathetic appreciation of the Latin Americans.

One who is at all interested in South America, be he professional or business man, will find this a most valuable book. C. J. P.

MINERALOGY, AN INTRODUCTION TO THE THEORETICAL AND PRACTICAL STUDY OF MINERALS. A. H. Philips, Macmillan Company. 682 pages. 533 figures. Price, $3.75.

Philips' Mineralogy ranks among the best texts on mineralogy recently published in the United States. It is no short cut, get-there-easy, vest-pocket guide on a royal road to mineralogy. It is an excellent, comprehensive presentation of the subject, adapted to the use of students who have studied chemistry and physics. While Dana still remains the great text of mineralogy because of its thoroughness and scope, the book by Phillips may be superior in some respects. The especially commendable features of Phillips' work are, a lucid discussion of the principles and technique of drawing crystals in various projections; a chapter on the origin of minerals, and a combination of both descriptive and determinative mineralogy under one cover, with tables for the determination of minerals by optical, megascopic, and chemical characteristics.

The book is well illustrated. It has fewer crystal figures than Dana's, but contains a large number of good photographs of crystal specimens instead. It classifies minerals according to the natural system of Dana, which groups minerals on the basis of their chemical and physical characteristics. For the student this is immeasurably superior to the arbitrary classification of minerals into groups which happen to contain the same useful element or elements. EDWARD STEIDTMANN.

JAPANESE AGRICULTURE

"The intensive culture, small arable area (14.37 per cent of the total area), and dense population in Japan have combined to produce exceedingly small land holdings. Dwarf farming prevails. Two and one half acres is the average farm per family. In 1908, a little over 60 per cent of the population lived by farming; of these over half tilled fields of less than 2 acres, while only 1 per cent of the farmers held more than 12 acres. In Owari province, a rich coastal plain, the per capita allowance of land to the rural population twenty years ago was barely ½ acre. This is the per capita for the whole island of Hondo today; but it drops to 0.432 acre in

the island of Kiushiu, and to 0.426 acre in Shikoku. A per capita of 1½ acres is found in only four provinces."

"This pulverization of the land appears again in another form: each farm is made up of several scattered fields. According to the last available returns in Japan proper, 53 per cent of the paddy-fields consist of lots less than ⅛ of an acre in extent, while the upland farms generally consist of lots measuring double that area. This piecemeal subdivision of the farms means a considerable waste of productive area in the boundary ridges between the fields, where these are not planted, but left as footpaths for the farmers going to their work. To remedy the evil, the Government is engaged in a system of adjustment to increase the average of the paddy lots to ½ acre or more. This change, by the economy of space lost in the boundary ridges, will recover 3 per cent of the total area so adjusted, and it will increase the yield 15 per cent."

"From time immemorial the farms have furnished the chief productive power of the Japanese people. Agriculture still constitutes the basis of the national finance. The industries and commerce are there only nascent; so they need the coddling of light taxation. The farmer class is therefore still the main support of the nation. Hampered by the limitation of a cramped area, it has been forced to shoulder a crushing burden. The land tax at present amounts to 8 per cent of the value of the field. This together with other local rates adds up to 12.5 per cent as direct taxation."

"The dwarf farms of 2½ acres which must support a family of 5 or 6 can ill afford such a drain. Consequently, small peasant proprietors are disappearing at an alarming rate. Their farms are being mortgaged and absorbed into larger estates. During the last decade, 10 per cent of the total land under cultivation was transferred to the class of tenant farms from that of fee-simple holdings. The condition of the Japanese farmer today is therefore pitiable. He and his family work early and late. They are simple, frugal, patient, uncomplaining—monuments of mute patriotism.—[Ellen Churchill Semple in *The Geographical Journal,* Dec. 1912.]

THROUGH THE ROCKIES TO THE N. E. A. AT SALT LAKE CITY, JULY, 1913

EASTERN teachers who contemplate attending the National Education Association at Salt Lake City in July, may be able to add much to the value of their trip by carefully planning their route in advance. There is much that is worth seeing between the Front Range of the Rockies and Salt Lake City, and much more in other parts of the Cordilleran region. It may take a little longer to take the mountain trip wholly in daylight, but the magnificent scenery will repay this small loss many fold.

Tourists should plan to cross Colorado by one route going west and by another returning. Several roads connect Denver and Salt Lake City. The various divisions of the Denver and Rio Grande probably reach the largest number of places of interest. By using the northern or main line on the west-bound trip and one of the southern links on the return trip, a large proportion of the scenic places of Colorado may be seen. The following

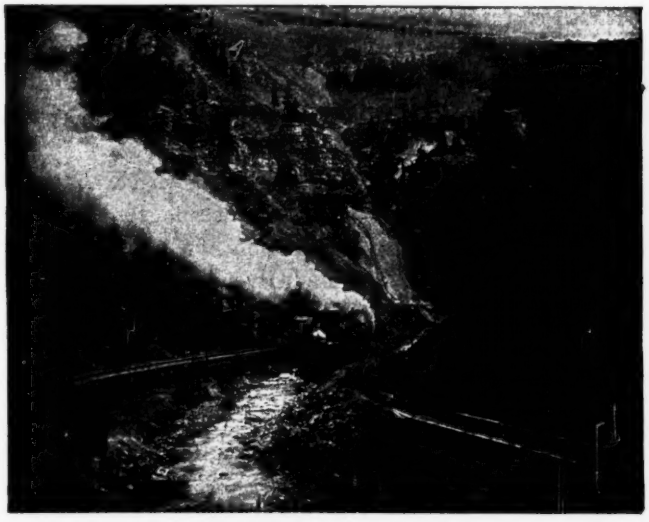
RUBY CASTLE, GRAND RIVER CANYON

brief sketch indicates some of the more noted places that may be conveniently visited on the westward journey from Denver.

From Denver to Pueblo, 120 miles, the Denver and Rio Grande runs south, with the Front Range of the Rockies on the west and the Great Plains stretching off to the east. Between Denver and Pueblo is Colorado Springs from which a branch line leads to Manitou. The famed Garden of the Gods is a short distance out of Manitou and Pikes Peak is reached by a cog railroad. The Ute Pass and North and South Cheyenne Canyons are also easily reached.

Pueblo, the second city of Colorado in size, referred to by its residents as "The Pittsburgh of the West," is at the point where the railroad turns abruptly westward to follow the Arkansas River through the Front Range. At Canyon City, the road enters one of the most wonderful defiles of the West,—the Royal Gorge of the Arkansas. It is ten miles long, a half mile deep, and very narrow (only 30 feet in one place). In the early days the possession of this gap was seen to be of such strategic importance that two railroad companies nearly came to war in their efforts to hold it. Special open-top cars are used in summer for the canyon trips.

Fifty miles beyond the Royal Gorge, the railroad forks, the main line crossing the Continental Divide by way of Tennessee Pass, and the narrow gage line crossing it at Marshall Pass; both passes are over 10,000 feet high,



EAGLE RIVER CANYON

and a mile above the Arkansas River at the Royal Gorge. The narrow gage line passes through the Black Canyon of the Gunnison, and the Uncompahgre Valley to Grand Junction. The main line, after zig-zagging over Tennessee Pass, runs through Red Cliff Canyon, near the Mount of the Holy Cross, into the Eagle River Canyon, with its cliff walls, 2000 feet high, honeycombed with mines. Farther on is the narrow canyon of the Grand River, with almost vertical cliffs 2500 feet high, Glenwood Springs, Grand Valley and Grand Junction, one of Colorado's widely known irrigated orchard regions. At Utaline, midway of the Ruby Canyon, the railroad passes into Utah.

CASTLE GATE, UTAH

From here to Salt Lake City, 260 miles, the route is through canyons, among mesas, across alternating stretches of desert and irrigated lands, passing for miles along Lake Utah, through prosperous Mormon towns, with the great wall of the Wasatch Mountains on the east, to Salt Lake City. The city itself is full of interest, clean, carefully planned, and excellently built. Nowhere in America can such music be heard as that of the great organ in the Mormon Tabernacle, to which visitors are admitted and for whom recitals are given.* R. H. W.

The Hills of Peru, a description of south-eastern Nebraska, epitomizes the old river town, in steamboat days, in its decadence, and in its rejuvenation. It is a literary treatment of a section of country about which little has been written, and deserves a place in every public library. Price $1.30 postpaid. Address the author, Louise W. Mears, Milwaukee State Normal School.

*Prospective tourists may obtain descriptive, beautifully illustrated booklets, maps, etc., from the General Passenger Agent, D. & R. G. R. R., Denver, Colo. The illustrations in this article are supplied by the courtesy of the Railroad Company.

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